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In Re Application of: Laurence James Crew
US Application Number: 10/718,595
Filing Date: 24 November 2003
Title: Computer Mouse with Magnetic Orientation Features
Group Art Unit: 2674
Examiner: EDOUARD, Patrick Nestor
Attorney Docket No: HIF0002U

23 January 2007

Dear Sirs,

We note that the Certificate of Grant did not issue with the priority details attached on the above application. Accordingly, we now enclose:

- a) Certified copy of Australian Provisional Application No. 2002952977;
- b) Certificate of Correction on the above United States Design Patent;
- c) Credit Card Payment form (2038) for \$100.00.

Please reissue the Certificate of Grant to include the priority details being Country: Australia; Priority No. 2002952977; and Priority Date: 28 November 2002.

Please charge any deficiency in the fees due to our Deposit Account No. 503458

Regards,

Michael Molins
Michael Molins
Reg. No. 31785
Customer No. 33372

03/02/2007 SZEWDIE1 00000059 7154475
01 FC:1811 100.00 OP
03/02/2007 SZEWDIE1 00000058 10710595
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01 FC:1811 100.00 OP

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**UNITED STATES PATENT AND TRADEMARK OFFICE
CERTIFICATE OF CORRECTION**Page 1 of 1

PATENT NO. : US 7,154,475

APPLICATION NO.: 10/718,595

ISSUE DATE : 26 December 2006

INVENTOR(S) : Laurence James Crew

It is certified that an error appears or errors appear in the above-identified patent and that said Letters Patent is hereby corrected as shown below:

The first page of the Patent does not list the priority information, being:

Country: Australia Priority No.: 2002952977 Priority Date: 28 November 2002

MAILING ADDRESS OF SENDER (Please do not use customer number below):

Michael Molins, Molins & Co.
Suite 5, Level 6, 139 Macquarie Street
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This collection of information is required by 37 CFR 1.322, 1.323, and 1.324. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.14. This collection is estimated to take 1.0 hour to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. SEND TO: Attention Certificate of Corrections Branch, Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.

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I, JANENE BRYDE, TEAM LEADER EXAMINATION SUPPORT AND SALES hereby certify that annexed is a true copy of the Provisional specification in connection with Application No. 2002952977 for a patent by HI-FI DESIGN PTY LTD as filed on 28 November 2002.

WITNESS my hand this
Eighteenth day of January 2007

JANENE BRYDE
TEAM LEADER EXAMINATION
SUPPORT AND SALES



CERTIFIED COPY OF
PRIORITY DOCUMENT

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AUSTRALIA
PATENTS ACT 1990

Patent Request: Provisional Application

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[54] Title: Computer Mouse with Magnetic Orientation Features

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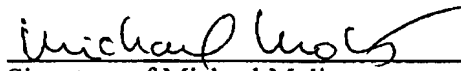
Attorney's Reference: HIFI 1

IP Australia
Documents received on:

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Sydney

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Signature of Michael Molins
Patent Attorney for the Applicant

28.11.02

Date

ABN 38 113 072 755

MAR - 6 2004

Computer Mouse with Magnetic Orientation Features

Field of the Invention

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The invention pertains to a computer mouse and more particularly to a mouse which recognises its own geomagnetic orientation and uses that orientation to transmit a related signal to a computer. In this way the mouse can obtain human inputs corresponding with three distinct degrees of freedom.

10

Background of the Invention

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A mouse for a computer is a form of interface in which the movement and position of the mouse, together with mouse button or switched inputs may be used as inputs to a computer. A conventional mouse may transmit signals to a computer in any of a number of ways. These signals may be interpreted by the computer's software drivers to accomplish a range of functions such as alter the position of a cursor, open menus, select objects or issue commands. In general, the position of the mouse on a physical desktop is translated into a position of a cursor on a screen. In the prior art, the computer mouse has been insensitive to geomagnetic orientation and has not used geomagnetic orientation for any purpose. However because software is becoming ever more sophisticated and greater means of interfacing with software are ever in demand, the need exists for additional forms of user interface and user input apart from those which are already in use. In the following disclosure the example of a wireless mouse is employed. It will be appreciated that both conventional or wireless data transmission from the mouse are useful, with wireless data transmission providing the more elegant and user friendly solution.

30

Objects and Summary of the Invention

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It is an object of the invention to provide a mouse which is adapted to recognise geomagnetic orientation and provide an output signal to a computer based on geomagnetic orientation.

10

It is also an object of the invention to provide a mouse which is insensitive to geomagnetic orientation when in pure translation.

It is another object of the invention to provide a wireless mouse which may be used in any rotational orientation.

15

Accordingly there is provided a mouse in which is located a geomagnetic sensor. The sensor produces a signal based on the rotation of the mouse, which signal which may be combined with signals produced by the mouse's optical sensor to create an output to a computer which is representative of three degrees of freedom. In preferred embodiments, signals related to the translation of the mouse are insensitive to the compass orientation of the mouse. In other embodiments, there is a threshold of rotational movement below which the device is insensitive. In preferred embodiments, the mouse is wireless.

25

Brief Description of the Drawing Figures

30

Figure 1 is an exploded perspective of a mouse according to one embodiment of the present invention.

Figure 2 is a schematic diagram explaining offset compensation according to one embodiment of the present invention.

Figure 3 is a schematic diagram of a computer circuitry according to one
5 embodiment of the present invention.

Best Mode and Other Embodiments of the Invention

10 Provided is a computer mouse with three degrees of freedom. The mouse works in a similar manner to a normal computer mouse, with the additional feature of providing a third degree of freedom. The third degree of freedom is user generated by rotating the mouse on the desktop. This provides an input
15 on the 'z' axis in addition to the normal 'x' and 'y' axes. The 'z' axis or component is input by rotation of the mouse but may be used to represent a number of graphic user interface features such as zoom through an axis, movement through layers of an on-screen graphic presentation, scrolling, rotation of 3-D graphic representations on screen, or panning.

20 As shown in figure 1, the mouse 10 comprises a cylindrical chassis 11 to support within its inner periphery, a first circuit board 12 which carries a conventional optical sensor 13, one or more (preferably 3) primary switches 14 and the RF transmission chip set 15. In addition, the circuit board 12
25 incorporating a solid state compassing device 16, consisting of two linear magnetic sensors (LMS) mounted at 90 degrees to each other, to determine the orientation of the mouse relative the Earth's magnetic field. Wireless transmission allows the mouse 10 to send movement data to a base station (RF receiver), then to the host computer. This allows the mouse to be rotated
30 freely without the limitation of a wire tether. A lens assembly 17 is mounted below the circuit board 12.

A second circuit board 20 is mounted above the first circuit board. The second circuit board holds the batteries 21 which power the device, a secondary switch 22 and an orientation switch 23.

5 A semi-rigid shell 25 is interposed between a flexible outer cover 26 and the second circuit board 20. The shell 25 transmits downward force on the cover to the secondary switch 22. The cover extends over the outer peripheries 27, 28 of the first and second circuit boards 12, 20. In this way a squeezing of the lower rim 29 of the cover 26 is transmitted to at least one of the primary
10 switches 14. The switches are wired in parallel with each other so that actuating any combination of the switches will result in the button press being registered. In preferred forms, at least one of the primary switches is assuredly activated by squeezing the lower rim 29 at diametrically opposite positions.

15 In some optional embodiments, a ball race 30 and ball bearings 31 are interposed between the chassis 11 and a retaining ring 32. This allows the base, being a low friction pad 36 to remain free from rotation while the components above the ball bearings 31 are free to rotate. This also allows the mouse to be rotated without 'wandering' in the 'x' or 'y' direction, by providing a
20 lower friction coefficient in the rotational mode than in the linear mode.

The mechanism for sensing the 'x' and 'y' movement of the mouse is the conventional optical mouse sensor device 13, 17 etc. By combining the 'x' and 'y' movement from the optical sensor with the change in rotation angle (z) from
25 the linear magnetic sensors 16, three degrees of freedom of control are able to be simultaneously achieved. These three movements are converted into RF data packets which are transmitted to the computer's optional RF receiver. In one embodiment the "z" information replaces the information normally attributed to the scroll wheel in a wireless or conventional scrolling mouse.

30 Since the angle of orientation of the mouse with respect to its environment is always known from the linear magnetic sensors 16, any movement in the 'x'

and 'y' directions can be compensated so that the spatial mapping from the desktop to the computer screen is maintained regardless of the fact that the mouse is being rotated.

5 Since the angle of orientation of the desktop relative to the Earth's magnetic field is unknown, it is necessary to provide a means of setting the *base orientation*. This is achieved by providing an orientation switch 23. The orientation switch is accessed by the user by providing a mechanical button 33 which fits within an opening 34 in the cover 26, through an opening 35 in the
10 shell and impinges on the orientation switch 23. At the time that the orientation switch is activated, the angle of rotation is stored in computer memory as the base orientation angle.

During operation, the *offset angle* is determined by the following formula:

15
$$\text{offset angle} = \text{compass reading} - \text{base orientation angle}$$

As shown in figure 2, all movements of the mouse 10 are compensated based on the offset angle by converting from Cartesian to polar coordinates, then
20 adding the offset angle, then converting back to Cartesian coordinates.

When the mouse is used for two dimensional operations with the 'z' axis used for window scrolling, it is necessary to suppress the scrolling function while the mouse is being moved in the 'x' or 'y' directions. Otherwise, inadvertent
25 scrolling may occur as the mouse is rotated by small amounts during movement. If the mouse is being rotated without significant 'x' or 'y' movement, the scrolling function will be resumed. This may be done in software by incorporating a fixed or user set threshold for "z" axis movement. This may be done in hardware by providing a compass disabling switch on the mouse. This
30 may also be accomplished by using software to detect a condition of an existing button, for example disabling the compass if the orientation switch is depressed for 5 seconds.

If the target application requires simultaneous input from all three degrees of freedom, it will inform the context sensitive driver. Under these conditions no suppression of the rotational (z) axis will occur.

5

Since the mouse needs to be operated at any angle of rotation, the buttons also need to be orientation free. The solution is to use, as previously mentioned, a central or secondary, 'push' button 22 activated from the top of the mouse, and one or more 'squeeze' or primary buttons 14 radially oriented on the outside perimeter of the mouse to provide for two-button operation.

10

As shown in Figure 3, the mouse's on-board processor 40 receives inputs from the two LMS devices, the optical sensor, the central or secondary switch, the radial or primary switch or switches 14, and the orientation switch 23. It provides data to the mouse's on-board RF transmitter which sends data packets containing the x, y, z and button data. The computer's optional RF receiver 50 receives the transmission, decodes it with its microprocessor 51 and sends the decoded packet data, via an appropriate interface 52 to a context sensitive driver 53 which is associated with at least one software application 54.

15

20

Applications for the mouse include, but are not limited to: rotation of three dimensional objects on screen using the three degrees of freedom simultaneously; panning and zooming; operation of rotary interface controls; scrolling of window contents; and any other operation requiring up to three degrees of freedom of input control.

25

Hi-Fi Design Pty Ltd
By its Patent Attorney
Molins & Co.

30

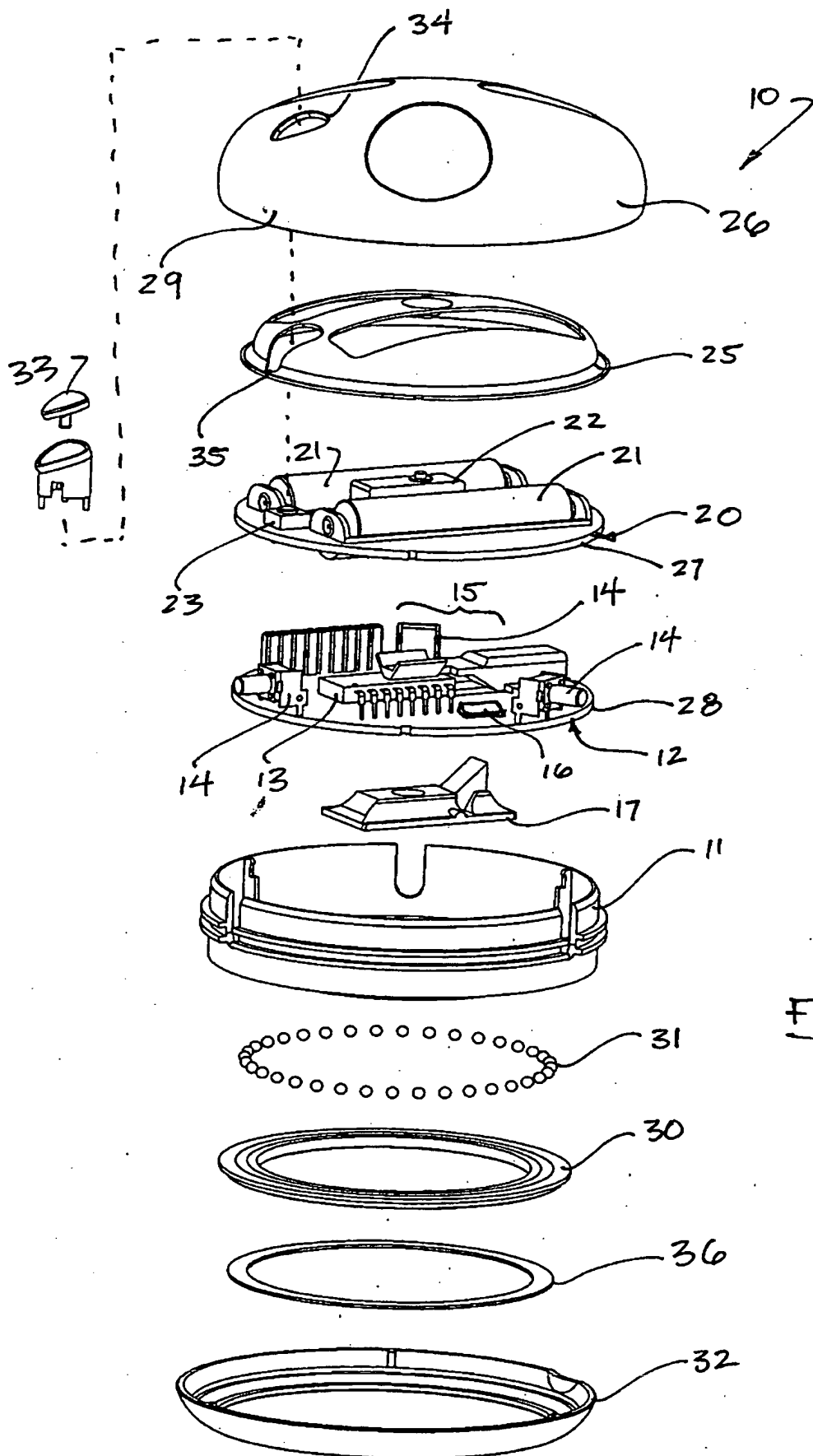


FIG. 1

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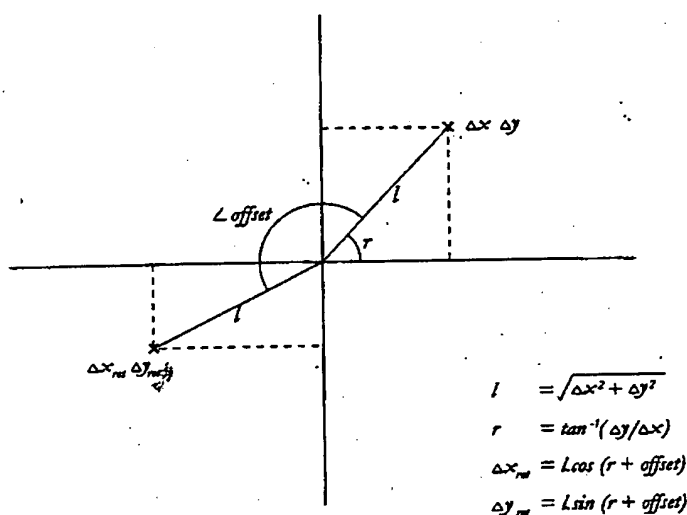


Fig. 2

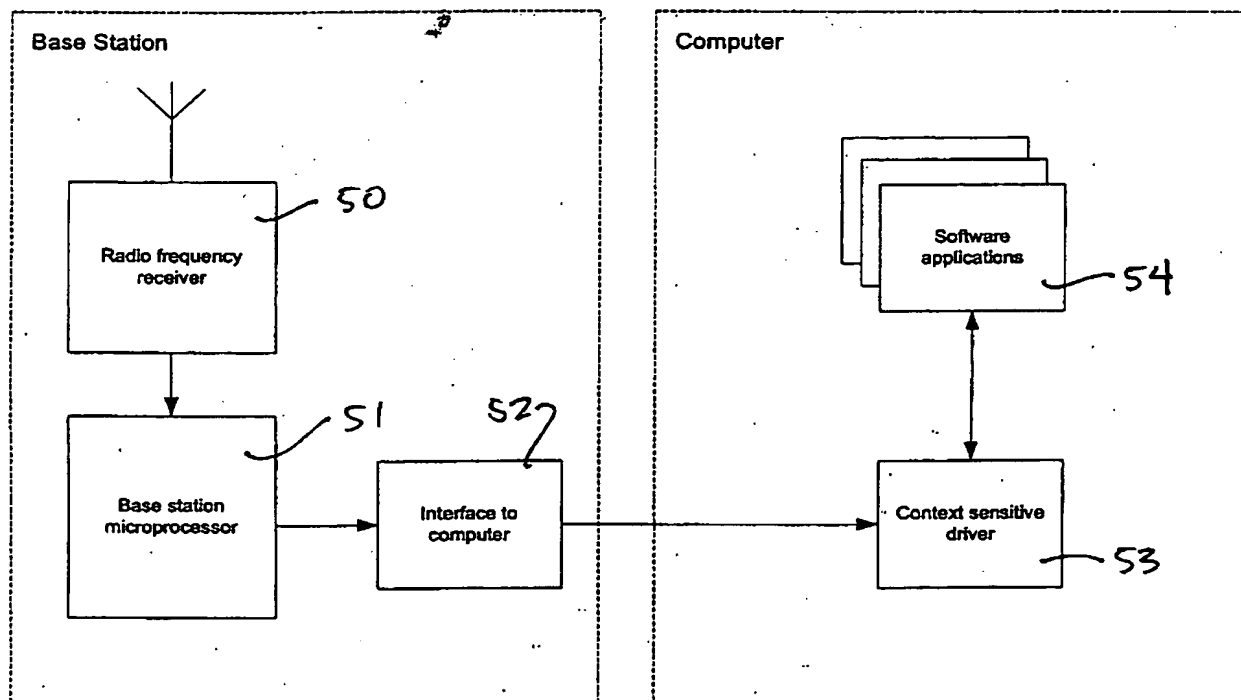
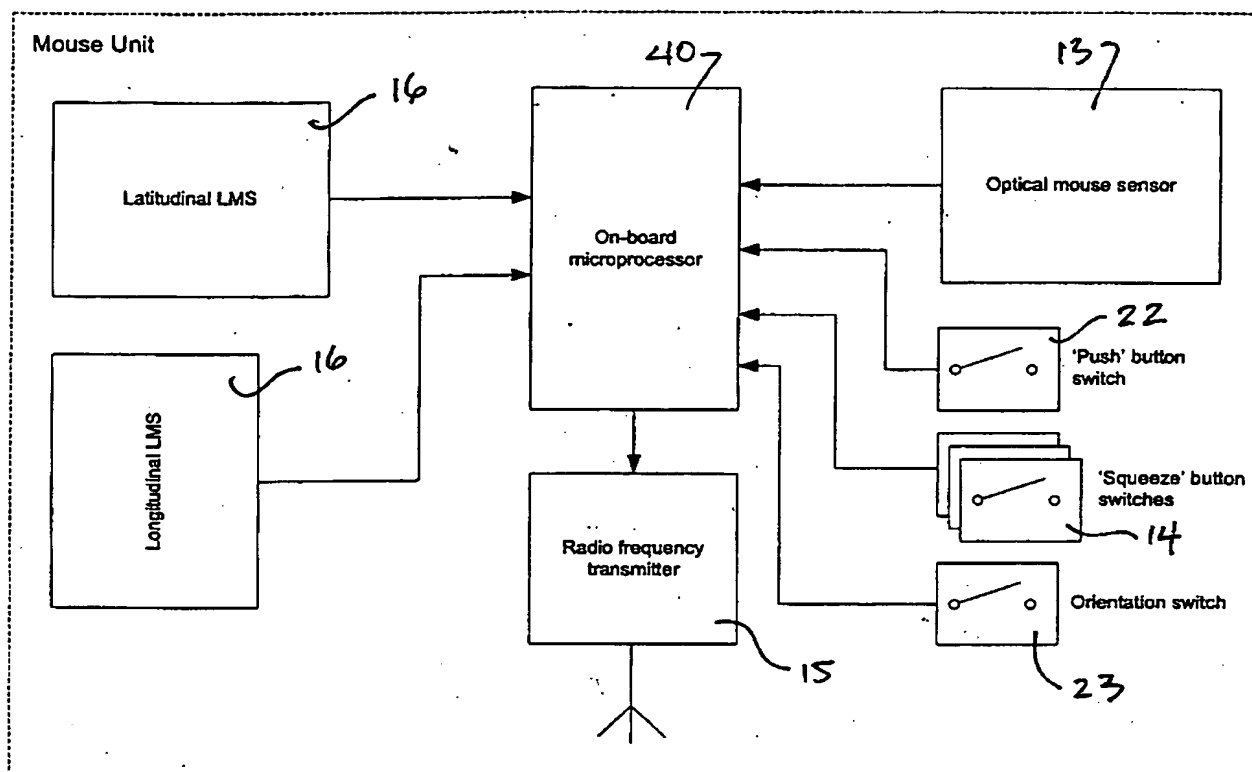


FIG 3

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